

REMARKS

Claims 13 and 16-23 are pending in this application. By the Office Action, claims 13 and 16-22 are rejected under 35 U.S.C. §112, and claims 13 and 16-23 are rejected under 35 U.S.C. §103. By this Amendment, claim 13 is amended for clarity only. No new matter is added.

I. Rejection Under §112

Claims 13 and 16-22 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite. By this Amendment, claim 13 is amended to clarify the claim language.

Accordingly, claim 13 is not indefinite. Reconsideration and withdrawal of the rejection are respectfully requested.

II. Rejections Under §103

A. Claim 23

In paragraph 5 of the Office Action, claim 23 is rejected under 35 U.S.C. §103(a) over Fujumura in view of JP 09-043581 as evidenced by Clark. In paragraph 6 of the Office Action, claim 23 is rejected under 35 U.S.C. §103(a) over JP 09-043581 in view of Fujumura as evidenced by Clark. In both rejections, Shimizu is relied upon as an equivalent form of JP 09-043581. Applicants respectfully traverse the rejections.

Claim 23 is directed to a device comprising: a pair of electrodes; a liquid crystal material filled into a gap between said electrodes, the liquid crystal material comprising a rod-shape liquid crystal compound, said liquid crystal material having a property such that charge-transport properties are varied according to a phase transfer between a plurality of stable liquid crystal phases of the liquid crystal and/or a history of the phase transfer, the phase transfer of the liquid crystal material occurring upon a change in temperature of the liquid crystal material between a crystalline phase at a room temperature to an isotropic phase in a final state through a smectic phase at an elevated temperature, and a thickness of the gap

between the electrodes being smaller than a domain size of the liquid crystal compound in a cooled state from the isotropic phase in a final state; and the device is configured so that information can be recorded by application of thermal energy to an area of the device, and recorded information can be read by detecting a value of photoelectric current generated by light applied to the area of the device at which information was recorded. Such a device is nowhere taught or suggested by any combination of the cited references.

Fujumura is newly cited in the Office Action. Fujumura discloses an information recording medium comprising a substrate, a pair of electrodes, and a liquid crystal material filled into a gap between the electrodes, as shown in Fujumura Fig. 1. Fujumura is cited as disclosing a gap between the pair of electrodes as being 5.19 microns, within the range disclosed in the present application. The Office Action admits that Fujumura does not disclose that the liquid crystal material comprises a rod-shaped liquid crystal compound. However, the Office Action cites Shimizu as teaching a liquid crystal material having a chiral smectic C, and Clark as teaching that a liquid crystal material having a chiral smectic C has a rod-shape.

The Office Action also cites Shimizu as disclosing an information recording medium comprising a substrate, a pair of electrodes, and a liquid crystal charge transfer material filled into a gap between the electrodes, as shown in Shimizu Fig. 2. As mentioned above, the Office Action cites Shimizu as disclosing a liquid crystal material having a chiral smectic C, and Clark as teaching that a liquid crystal material having a chiral smectic C has a rod-shape. The Office Action admits that Shimizu does not teach a specific thickness of a gap between the electrodes, but cites Fujumura as disclosing a gap thickness within the scope of the present application.

The Office Action concludes that it would have been obvious to use the liquid crystal material having a rod-shape to obtain a display image with excellent sharpness and

brightness. The Office Action thus concludes that it would have been obvious to use such a liquid crystal material in the display devices of Shimizu or Fujumura, and to use a gap thickness between the electrodes as disclosed in Fujumura, to practice the claimed invention. Applicants respectfully disagree.

The cited references, in any combination, at least fail to teach or suggest the claim limitation that the device is configured so that information can be recorded by application of thermal energy to an area of the device, and recorded information can be read by detecting a value of photoelectric current generated by light applied to the area of the device at which information was recorded. That is, the device is configured so that information can be recorded by application of thermal energy, such as by a thermal head or a laser beam. However, not all display devices are configured in this manner, and the mere provision of an information recording medium comprising a substrate, a pair of electrodes, and a liquid crystal charge material filled into a gap between the electrodes, does not inherently or obviously provide a device wherein information can be recorded by application of thermal energy to an area of the device, as claimed. The claimed device is thus distinct and non-obvious from the combinations of the cited references.

Fujumura discloses a completely different liquid crystal device. In Fujumura, the device is driven by applying ON and OFF electric fields to the liquid crystal material to obtain an ON/OFF state of the device. See, for example, Fujumura at Abstract. Thus, the basic concept of Fujumura is entirely different from the claimed invention.

In a similar manner, Shimizu also discloses a completely different liquid crystal device. Shimizu discloses the use of an information recording medium comprising a photoelectric sensor and a liquid crystal. According to Shimizu, the information recording can be made by the variation in the electric field according to an information light from the photoelectric sensor. See, Shimizu at col. 10, lines 35+. In fact, Shimizu's structure is even

different from the claimed invention and from that of Fujumura. Referring to Figs. 1 and 2 of Shimizu, it is apparent that the two-layer structure of the information recording layer 11 comprises a liquid crystal material and a photoconductive layer 14 comprising a charge transporting/generating substance. This two-layer structure is essential for operation of the Shimizu device. Thus, the basic concept of Shimizu is also entirely different from the claimed invention.

Neither Fujumura nor Shimizu, alone or in combination, teach or suggest the claimed invention. As described above, each of Fujumura and Shimizu teach a display device where information is recorded using an electric field, not a display device where information recording is conducted by applying thermal energy to an area of the device, as claimed. Nowhere does either reference teach or suggest that the devices configured for information recording using an electric field could or should be modified to provide a device configured for information recording using thermal energy. The references entirely fail to teach or suggest that the disclosed liquid crystal material or liquid crystal charge transfer material could or should be used for information recording using thermal energy. These teachings are entirely missing from Fujumura and Shimizu.

Furthermore, it is improper for the Office Action to discount the instant limitations of claim 23 as "functional language" or as being inherent in the structures of Fujumura and Shimizu. The Office Action fails to establish that the Fujumura or Shimizu devices would "inherently" operate for recording information by the use of thermal energy, as claimed. In order to establish a prima facie case, it is incumbent on the Patent Office to establish this asserted inherency. See In re King, 231 U.S.P.Q. 136 (Fed. Cir. 1986). The Office Action must provide a basis in fact and/or technical reasoning to reasonably support the assertions that the allegedly inherent characteristic of the Fujumura or Shimizu devices necessarily

flows from the teachings of the references. See Ex parte Levy, 17 USPQ2d 1461, 1464 (PTO Bd. Appl. & Int. 1990).

Absent some additional teaching that establishes that the Fujumura or Shimizu devices necessarily achieve this feature of the device of claim 23, i.e., that the devices are necessarily configured to operate for information recording by the use of thermal energy, the Office Action fails to establish the asserted inherent operation of the cited references. Moreover, any such additional teaching relied upon for the purpose of establishing inherency of operation of the Fujumura or Shimizu devices, "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." See Continental Can Co. v. Monsanto Co., 20 USPQ2d 1746, 1749 (Fed. Cir. 1991). No such additional teaching is presented in the Office Action.

Still further, Clark does not overcome the deficiencies of Fujumura and Shimizu. Clark is cited only as disclosing that a liquid crystal material having a chiral smectic C is rod-shaped. However, Clark relates to a very specific electro-optical device, which utilizes a specific liquid crystal material that is described to have novel electro-optical properties. The novel electro-optical properties of the material in Clark are caused by a specific change of the molecular orientation of the liquid crystal compound. Clark thus does not purport to describe, and does not teach or suggest, the properties of any or all generic liquid crystal materials having a chiral smectic C. In contrast, none of the claimed invention, Fujumura, or Shimizu appear to be directed to such specific electro-optical properties, and do not utilize Clark's change of the molecular orientation of the liquid crystal compound. Accordingly, Clark is at least improperly combined with Fujumura and Shimizu, because there was no apparent motivation for Fujumura or Shimizu to look to the very specific material of Clark.

For at least these reasons, any combination of the cited references would not have rendered obvious the claimed invention. One of ordinary skill in the art, seeking to improve upon the electric field recording devices of Fujumura or Shimizu, would not have been motivated to look to the very different liquid crystal of Clark. Nor would one of ordinary skill in the art have been motivated to take the combination of Fujumura, Shimizu and Clark, and modify the resultant combination to provide a device where information recording is conducted by the application of thermal energy, as claimed.

Accordingly, claim 23 is patentable over the cited references. Reconsideration and withdrawal of the rejections are respectfully requested.

B. Claims 13 and 16-23

In paragraph 7 of the Office Action, claims 13 and 16-23 are rejected under 35 U.S.C. §103(a) over Fujumura in view of EP 763 532. In paragraph 8 of the Office Action, claims 13 and 16-23 are rejected under 35 U.S.C. §103(a) over EP 763 532 in view of Fujumura. Applicants respectfully traverse the rejections.

Claim 13 is directed to an information recording medium comprising: a pair of electrodes; and a liquid crystal material filled into a gap between said electrodes, the liquid crystal material comprising a rod-shape liquid crystal compound; wherein the liquid crystal material has a property such that charge-transport properties are varied according to a phase transfer between a plurality of stable liquid crystal phases of the liquid crystal and/or a history of the phase transfer, the phase transfer of the liquid crystal material occurring upon a change in temperature of the liquid crystal material between a crystalline phase at a room temperature to an isotropic phase in a final state through a smectic phase at an elevated temperature; the liquid crystal material comprises a material selected from the group consisting of a phenylbenzothiazole liquid crystal, 4-hexyloxy-4-butanoylbiphenyl, and a phenylnaphthalene liquid crystal wherein the phenylnaphthalene is one selected from the group consisting of 2-

(4'-octylphenyl)-6-dodecyloxynaphthalene, 2-(4'-octylphenyl)-6-butyloxynaphthalene, 2-(4'-octylphenyl)-6-nonyloxynaphthalene and a mixture thereof; a thickness of the gap between the electrodes is larger than a domain size of the liquid crystal compound at least in the initial state of the liquid crystal material, and the thickness of the gap between the electrodes being smaller than a domain size of the liquid crystal compound in a cooled state from the isotropic phase in a final state; and the information recording medium is configured so that information can be recorded by application of thermal energy to an area of the medium, and recorded information can be read by detecting a value of photoelectric current generated by light applied to the area of the medium at which information was recorded. Claim 23 is discussed above. Such devices are not taught or suggested by any combination of the cited references.

As described above, Fujumura discloses an information recording medium comprising a substrate, a pair of electrodes, and a liquid crystal material filled into a gap between the electrodes, as shown in Fujumura Fig. 1. Fujumura is cited as disclosing a gap between the pair of electrodes as being 5.19 microns, within the range disclosed in the present application. The Office Action admits that Fujumura does not disclose that the liquid crystal material is one of the materials specifically selected from the Markush group set forth in the claims. However, the Office Action cites EP 763 532 as teaching a liquid crystal material made from 2-(4'-heptyloxyphenyl)-6-dodecylthiobenzothiazole).

The Office Action also cites EP 763 532 as disclosing an information recording medium comprising a substrate, a pair of electrodes, and a liquid crystal charge transfer material filled into a gap between the electrodes, as shown in Fig. 1. As mentioned above, the Office Action cites EP 763 352 as disclosing a liquid crystal material made from 2-(4'-heptyloxyphenyl)-6-dodecylthiobenzothiazole). The Office Action admits that EP 763 532 does not teach a specific thickness of a gap between the electrodes, but cites Fujumura as disclosing a gap thickness within the scope of the present application.

The Office Action thus concludes that it would have been obvious to use the liquid crystal material of EP 763 532 in the device of Fujumura, or to use the device of EP 763 532 with a gap thickness as disclosed in Fujumura, to practice the claimed invention. Applicants respectfully disagree.

The cited references, in any combination, at least fail to teach or suggest the claim limitation that the device is configured so that information can be recorded by application of thermal energy to an area of the device, and recorded information can be read by detecting a value of photoelectric current generated by light applied to the area of the device at which information was recorded. For all of the reasons set forth above, Fujumura does not teach or suggest this feature, nor is this feature taught or suggested by EP 763 532.

Furthermore, the references do not teach or suggest the claim limitation that a thickness of the gap between the electrodes is larger than a domain size of the liquid crystal compound at least in the initial state of the liquid crystal material, as defined in claim 13, and the thickness of the gap between the electrodes being smaller than a domain size of the liquid crystal compound in a cooled state from the isotropic phase in a final state, as defined in claims 13 and 23. Not all display devices are configured to have these relationships between the thickness of the gap and the domain sizes of the liquid crystal compound between the two (initial and cooled) states, and the mere provision of a gap between the electrodes with a liquid crystal charge material filled into the gap, does not inherently or obviously provide a device having the recited claim limitations. The claimed device is thus distinct and non-obvious from the combinations of the cited references.

As described above, Fujumura discloses a completely different liquid crystal device. In Fujumura, the device is driven by applying ON and OFF electric fields to the liquid crystal material to obtain an ON/OFF state of the device. See, for example, Fujumura at Abstract. Furthermore, although Fujumura provides a gap size of 5.19 microns, Fujumura does not

teach or suggest how that specific gap size corresponds to the domain sizes of the liquid crystal material in the initial and cooled states, as required in the claims. Thus, the basic concept of Fujumura is entirely different from the claimed invention.

In a similar manner, EP 763 532 also fails to teach or suggest any specific gap size, much less how a specific gap size corresponds to the domain sizes of the specific liquid crystal material in the initial and cooled states, as required in the claims. EP 763 532 thus also fails to teach or suggest these claim limitations.

The relation between the gap thickness and the domain sizes of the liquid crystal in the initial and cooled states is not only an express claim limitation, but is important feature of the claimed invention. This relationship is important to obtain the charge transport properties according to the claimed device. However, neither the limitation nor its associated benefits are taught or suggested by the cited references.

For at least these reasons, any combination of the cited references would not have rendered obvious the claimed invention. One of ordinary skill in the art, seeking to improve upon the devices of Fujumura or EP 763 532, would not have been motivated to look to the teachings of the other reference. Nor would one of ordinary skill in the art have been motivated to take the combination of Fujumura and EP 763 532, and modify the resultant combination to provide a device where information recording is conducted by the application of thermal energy, and where there is the specific relationship between the gap thickness and the domain sizes of the liquid crystal in the initial and cooled states, as claimed.

Accordingly, claims 13 and 16-23 are patentable over the cited references.


Reconsideration and withdrawal of the rejections are respectfully requested.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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